**REVIEW OF HARDSHIP EXCEPTION REQUEST SUBMITTED BY RAHWAY ARCH PROPERTIES**
**FEBRUARY 2014**

This document serves as a further evaluation of the hardship exception request pursuant to N.J.A.C. 7:13-9.8 originally submitted by Rahway Arch Properties, LLC (Rahway Arch) on November 2012, as supplemented by a January 17, 2013 Detailed Alternatives Analysis (January 2013 Analysis).Rahway Arch (applicant) has provided the following additional documents to supplement the original application and alternatives analysis:

1. Final Remedial Action Workplan (RAWP) and Licensed Site Remediation Professional (LSRP) certification form submitted July 16, 2013. The RAWP was supplemented by the LSRP in an addendum on August 15, 2013 and an August 23, 2013 clarification letter. The LSRP for the site is Albert Free, EastStar Environmental Group, Inc. (LSRP License #575600). The original RAWP was submitted to the SRP on November 27, 2012

2. August 29, 2013 letter from Lloyd Tubman of Archer and Greiner who represents Soil Safe, Inc., engaged by Rahway Arch to remediate the site. This letter provided additional hardship exception documentation following submission of the July 16, 2013 RAWP. Exhibit B of the August 29 letter included a June 18, 2013 letter from the LSRP which provided additional technical information related to the January 2013 Analysis.

3. A letter dated September 5, 2013, from the LSRP to Commissioner Bob Martin which provides additional information on the remedial strategy for the site.

4. A November 14, 2013 document entitled "Rahway Arch Site Remediation, Information in Support of Land Use Permit and Flood Hazard Hardship Waiver."

In evaluating Rahway Arch's application for a hardship exception, the New Jersey Department of Environmental Protection (Department) reviewed the above, as well as the following:

5. A document entitled "Alternative and Clean Fill Guidance for SRP Sites, Updated December 29, 2011, Version 2," NJDEP Site Remediation Program.

6. Solid Waste Regulations, N.J.A.C. 7:26 *et seq.*

7. Recyclable Material Regulation, N.J.A.C. 7:26A *et seq.*

8. Flood Hazard Area Control Act Regulations, N.J.A.C. 7:13-1.1 *et seq.*

As presented in Attachment 1 of the permit issued May 24, 2013, the applicant is seeking a hardship exception or a determination that a hardship exception is not required from three Flood Hazard Area regulations in order to remediate the site under the provisions of the Site Remediation Program, Technical Requirements for Site Remediation, N.J.A.C. 7:26E *et seq.* The Flood Hazard Area rules evaluated herein are:

1) **N.J.A.C. 7:13-11.16, Requirements for the Storage of Unsecured Material.** This regulation states that this section governs this type of activity if not addressed under N.J.A.C. 7:13-11.17 and N.J.A.C. 7:13-11.18. This regulation will be addressed under the review of the hardship exception request under N.J.A.C. 7:13-11.17.
2) **N.J.A.C. 7:13-11.17, Requirements for the Storage, Processing and Placement of Hazardous Substances**
3) **N.J.A.C. 7:13-11.18, Requirement for the Storage, Processing and Placement of Solid Waste**

**N.J.A.C. 7:13-11.18, Requirement for the Storage, Processing and Placement of Solid Waste**

The Solid Waste Regulations at N.J.A.C. 7:26-1.6(a) define solid waste as follows:

7:26-1.6 Definition of solid waste

(a) A solid waste is any garbage, refuse, sludge, or any other waste material except it shall not include the following:

2. Recyclable materials that are exempted from regulation pursuant to *N.J.A.C. 7:26A*;
3. Materials approved for beneficial use or categorically approved for beneficial use pursuant to *N.J.A.C. 7:26-1.7(g)*;

7:26-1.7 Exemption from SWF permitting

(g) This subsection sets forth the specific criteria for exempting beneficial use projects.

4. The following materials are categorically approved for beneficial use and require no future approval or authorization for use or reuse provided they are used or reused in a manner consistent with *N.J.A.C. 7:26-1.1*:

    v. Contaminated soil that has been decontaminated to the satisfaction of the Department and is used or reused in a manner acceptable to the Department;

The material, petroleum contaminated soil and concrete, asphalt, brick and block (CABB), to be processed at the Class B Facility will be regulated under the Recycling Regulations (N.J.A.C. 7:26A *et seq.*), not the Solid Waste Regulations because, as explained below, the material is exempt from solid waste facility permitting. The petroleum contaminated material that will be processed at the facility will be treated to soil remediation standards that will allow for it to be beneficially used in the remediation of the site in accordance with the RAWP and specifically the Fill Use Plan contained in Section 7 of the RAWP. The recycled soil will meet Residential Direct Contact Soil Remediation Standards (Residential Standards) for all parameters except six polynuclear aromatic hydrocarbons (PAHs) that currently exist on the site at concentrations that exceed the Residential Standards. As described in the Fill Use Plan, the concentrations of these six PAH compounds in the recycled soil will be less than the existing concentrations on the site.

The applicant also notes that the incidental amounts of CABB imported with the petroleum contaminated soil will be crushed and blended and used on site. This CABB is typically mixed with the petroleum contaminated soil and is generally less than 10% of the total weight of material processed at the Class B recycling facility. The LSRP has approved the Fill Use Plan that was developed in accordance with the December 29, 2011, Version 2, Alternative Fill and Clean Fill

Guidance for SRP Sites. This Guidance Document defines the levels to which contaminated soils must be treated to be placed on the site in order to comply with SRP Technical Requirements for Site Remediation, N.J.A.C. 7:26E. This guidance document also recognizes in Section 3.10 that alternative fill may be placed on SRP sites provided it complies with N.J.A.C. 7:26-1.7 (g) 4 v. Thus, provided the material is reused on the site consistent with the LSRP's approved RAWP and Fill Use Plan, it will be beneficially used on the site in a manner that is acceptable to the NJDEP, Site Remediation Program.

Given the above, the Department has determined that the petroleum contaminated soils and CABB to be processed and used to remediate the site do not constitute a solid waste under N.J.A.C. 7:26-1.6 (a)(3), and thus the Flood Hazard Area regulations at N.J.A.C. 7:13-18 are not applicable to this project.

**N.J.A.C. 7:13-11.17, Requirements for the Storage, Processing and Placement of Hazard Substances**

As discussed in Attachment 1 of the permit issued May 24, 2013, the project falls under the provisions of this regulation since petroleum contaminated soils are proposed to be imported to the Class B facility for processing, storage and placement on the site. For completeness, the following is taken from Attachment 1 in the existing permit:

> *Under the flood hazard area control act rules "Hazardous substance means material defined as such in the Spill Compensation and Control Act, N.J.S.A. 58:10-23.11." The Spill Compensation and Control Act states that "Hazardous substances means the "environmental hazardous substances" on the environmental hazardous substance list adopted by the department pursuant to section 4 of P.L.1983, c.315(C.34:5A-4); such elements and compounds, including petroleum products, which are defined as such by the department, after public hearing, and which shall be consistent to the maximum extent possible with, and which shall include, the list of hazardous substances adopted by the federal Environmental Protection Agency pursuant to section 311 of the federal Water Pollution Control Act Amendments of 1972, Pub.L.92-500, as amended by the Clean Water Act of 1977, Pub.L.95-217 (33 U.S.C. 1251 et seq.); the list of toxic pollutants designated by Congress or the EPA pursuant to section 307 of that act; and the list of hazardous substances adopted by the federal Environmental Protection Agency pursuant to section 101 of the "Comprehensive Environmental Response, Compensation and Liability Act of 1980," Pub.L.96-510 (42 U.S.C. 9601 et seq.); provided, however, that sewage and sewage sludge shall not be considered as hazardous substances for the purposes of this act." Please note the underlined portion of the definition in the Spill Compensation and Control Act. Petroleum products are defined as hazardous substances. Since the soils in question are contaminated with a hazardous substance (petroleum products), the placement, storage, and processing of those soils on-site is prohibited by the Flood Hazard Area Control Act Rules at N.J.A.C. 7:13-11.17. A* ***hardship exception has been requested from this section.***

The hardship exception request is based on the Department's interpretation as set forth in Attachment 1 that petroleum contaminated soil is a hazardous substance.

REVISED HARDSHIP EXCEPTION REVIEW

The Department has addressed Processing and Storage and Placement of petroleum contaminated soils (hazardous substances as defined above) separately in this evaluation.

Processing and Storage of Material at the Class B Facility

As stated by the applicant in the August 29, 2013 letter from Lloyd Tubman, and as verified by the DLUR Engineer in Attachment 1 of the May 2013 permit, the areas of the Class B facility to be used for the processing and storage of material will be located entirely above the Advisory Base Flood Elevation (ABFE) of 15' NAVD88 (North American Vertical Datum of 1988).

Specifically, the entire area of the site that will be used for the Class B facility will be raised above the ABFE prior to construction of the Class B facility. Immediately following completion of the remediation project, the temporary Class B facility will be dismantled and removed from the site and the area where the Class B facility was located will be capped as shown in the final remediation plans in the RAWP.

The Flood Hazard Area Control Act rules at *N.J.A.C.* 7:13-11.17 set forth requirements for the placement, storage or processing of hazardous substances in "regulated areas." Regulated areas include any "flood hazard area" and any "riparian zone" of the State. Since the entire area of the site that will be used for the Class B facility will be situated well above the flood elevation, this aspect of the project is not subject to flooding or the requirements of *N.J.A.C.* 7:13-11.17. The DLUR Engineer's review of the approved plans dated May 6, 2013, and of the RAWP as amended and supplemented through August 23, 2013, confirms that the Class B facility and all processing and storage of associated material will be situated above the ABFE and therefore not within a regulated flood hazard area. Therefore, the hardship exception requested by the applicant in November 2012, and identified as necessary by the Department prior to submission of the approved plans and the RAWP revision and supplements, is not required.

Note that FEMA released revised flood mapping for this location in July 2013 that eliminated the advisory V-Zone on the site and reduced the ABFE to 12' NAVD in some portions of the site and 13' NAVD on other portions of the site. This occurred after the site plans for the Class B recycling facility were finalized and submitted to NJDEP. Nevertheless, the applicant will continue to adhere to FEMA's prior ABFE and maintain the 15' NAVD elevation as the minimum elevation for the Class B recycling facility, resulting in the entire Class B facility being at either two or three feet above the current ABFE.

Placement of Material – Engineered Fill Placement for Remediation Purposes and Alternative Fill for Construction of the Temporary Class B Recycling Facility

The use of the engineered fill from the Class B recycling facility to remediate the site and the use of Alternative Fill (as defined by the SRP Alternative and Clean Fill guidance document) to create the Class B recycling facility itself requires a hardship exception from *N.J.A.C.* 7:13-11.17.

*N.J.A.C.* 7:13-1.2 defines "hazardous substance" as "material defined as such in the Spill Compensation and Control Act (Spill Act), *N.J.S.A.* 58:10-23.11". The Spill Act defines "hazardous substances" as the 'environmental hazardous substances' on the environmental hazardous substance list adopted by the Department...." The adopted list is Appendix A to *N.J.A.C.* 7:1E. Petroleum oil/motor oil is listed in Appendix A, and accordingly soil containing petroleum oil is considered a hazardous substance under the Spill Act. This is true regardless of the fact that the soil will be remediated pursuant to the Department's Technical Standards for Site Remediation. Therefore, placement of engineered fill below the ABFE is subject to the requirements of N.J.A.C. 7:13-11.17. In light of additional information since the original hardship exception application dated November 2012, as set forth above, the Department has further evaluated Rahway Arch's hardship exception request as follows.

## N.J.A.C. 7:13-9.8 – Hardship Exception for an Individual Permit

Applicants proposing projects that cannot meet the requirements for a flood hazard area individual permit can appeal to the hardship exception provision at N.J.A.C. 7:13-9.8. Under this provision, the Department can issue an individual permit for a regulated activity that cannot achieve strict compliance with the requirements of N.J.A.C. 7:13 in certain cases. Specifically, a project is eligible for a hardship exception if it meets at least one of the requirements listed at N.J.A.C. 7:13-9.8(a) (denoted as "first tier" below), and provided the project additionally meets all requirements listed at N.J.A.C. 7:13-9.8(b) (denoted as "second tier" below.)

First Tier

In order for the Department to entertain a hardship exception under an application for an individual permit, the applicant must first demonstrate one or more of the following:

*1. The Department determines that there is no feasible and prudent alternative to the proposed project, including not pursuing the project, which would avoid or substantially reduce the anticipated adverse effects of the project, and that granting the hardship exception would not compromise the reasonable requirements of public health, safety and welfare, or the environment;*

Alternatives Analysis

Attachment 1 of the issued permit provides a discussion by the DLUR engineer of the alternative analysis submitted in January 2013 by the LSRP along with the November 2012 hardship exception request. As was stated in the Alternatives Analysis report, the analysis was performed retrospectively to the remedial design and engineering process. Both the current and previous site owners explored many potential solutions to first and foremost remediate and secondly develop the site with little success. Repeated efforts, including discussions regarding those potential solutions with the Department, were made which considered a wide range of potential capping options. However each of these solutions was found to be not feasible for a variety of reasons.

The selection of the preferred process and remedy was made after a significant amount of consideration and effort, as well as extensive remedial and geotechnical investigations and analyses that allowed a feasible remedial design to be developed.

In this evaluation, the DLUR engineer, using Rahway Arch's analysis, identified two alternatives that were deemed "Satisfactory" by Rahway Arch and other alternatives that appeared to be feasible based on the limited information provided by Rahway Arch. Thus, the Department could not grant the hardship exception request in May 2013 and requested additional documentation from Rahway Arch at that time.

Rahway Arch in its August 29, 2013 letter provided additional information to support its hardship exception request. Specifically, Exhibit B consisted of a June 18, 2013 letter from Al Free, LSRP for the site, which more fully explained the evaluation of alternatives to remediate the site. Also included in the August 29, 2013 submission, was the July 16, 2013 RAWP submitted by the LSRP to the Site Remediation Program. It is noted that the original RAWP was submitted to the SRP on November 27, 2012. The RAWP underwent a SRP component review which resulted in the RAWP being supplemented by the LSRP in an addendum on August 15, 2013 and an August 23, 2013 clarification letter. The RAWP was deemed complete by the Site Remediation Program on August 26, 2013 under the provisions of the Administrative Requirements for the Remediation of Contaminated Sites (ARRCS), N.J.A.C. 7:26C.

For purposes of this revised alternatives analysis review, the following describes the remediation requirements as detailed in the July 16, 2013 RAWP approved by the LSRP (as amended):

- Eliminate direct contact hazard with contaminated surface fill materials and alum-YPS sludge
- Prevent precipitation from coming in contact with the contaminated materials and discharging to groundwater or surface water
- Promote runoff and evapotranspiration of precipitation rather than infiltration
- Ensure the long term integrity of the berms
- Eliminate site safety hazards posed by soft soils and sludge and ponded water in the impoundments
- Allow safe passive uses, including habitat, and possible future development on a portion of the site by the property owners, making at least a portion of the site usable.

This remedial action will consist of a combination of engineering and administrative controls. An engineered fill cap system will achieve the goals of the site remediation. Administrative controls will ensure that the cap remains protective and will address existing contaminant concentrations in the groundwater.

These requirements are further clarified in the Background section of the August 15 RAWP Addendum which describes all of the Applicable or Relevant and Appropriate Requirements (ARARs) applicable to remediation of this site.

By filing the July 16, 2013 RAWP (as amended), the LSRP has certified that the RAWP complies with the Technical Requirements for Site Remediation, N.J.A.C. 7:26E, and the Administrative Requirements for the Remediation of Contaminated Sites (ARRCS) as an acceptable remedial action to address contamination at this site. Upon completion of the Remedial Action in accordance with this RAWP, the LSRP anticipates that a Response Action Outcome (RAO) will be filed for the site in accordance with the ARRCS. An RAO is defined in in ARRCS at *N.J.A.C.* 7:26C-1.3 as a Final Remediation Document and means:

> *a written determination by a licensed site remediation professional that the site was remediated in accordance with all applicable statutes, rules and guidance, and based upon an evaluation of the historical use of the site, or of any area of concern at that site, as applicable, and any other investigation or action the Department deems necessary, there are no contaminants present at the site, at the area of concern or areas of concern, or at any other site to which a discharge originating at the site has migrated, or that any contaminants present at the site or that have migrated from the site have been remediated in accordance with applicable remediation statutes, rules and guidance and all applicable permits and authorizations have been obtained.*

Using the LSRP approved RAWP, a letter dated January 17, 2013 which provided a detailed alternatives analysis by the LSRP, and the LSRP's letter of June 18, 2013, which concluded that the only feasible remediation alternative for the site was capping the site with engineered fill material manufactured by a temporary Class B facility constructed on the site and removed upon completion of the remedial action, the Department has further evaluated the alternatives analysis for the remediation of the site. The Department's analysis follows.

Evaluation of Detailed Alternatives Analysis

1. *No Action Alternative*

The current site conditions are such that the alum-YPS lagoons and surrounding berms are unstable and present a site hazard. The site is in need of remediation to eliminate ongoing discharges to the underlying ground water and adjacent surface waters of the Rahway River and to address contamination issues on the site. The conditions on the site have been documented in numerous technical reports prepared by the Responsible Party (Cytec and its predecessors) and the LSRP and are summarized in the Remedial Investigation Report (RIR).

This No Action Alternative does not accomplish any of the remediation requirements established by the LSRP for the site or any of the requirements for site remediation contained in the Technical Requirements for Site Remediation (Tech Rule), N.J.A.C. 7:26E and the ARRCS. The No Action Alternative is not an acceptable alternative for remediation of this site.

2. *Excavation of Alum-YPS Sludge Lagoons and Surrounding Berms and Import Clean Fill*

This alternative would require the removal of approximately 2,000,000 tons of contaminated material from the site. The description of this alternative in the original January 2013 analysis did not provide enough information to clearly demonstrate that this remedial approach was not feasible but only stated that due to the high groundwater table, the ability for a contractor to compact the backfill would be impeded. Thus it was concluded that only coarse grained material that did not need to be compacted could be used in the remediation. However, Table 1 which evaluated the alternatives demonstrated that this alternative would only be marginally effective in eliminating infiltration and ensuring the long term stability of the site. Additionally, as shown in Table 3, this alternative was only marginal in its ability to meet the short term effectiveness, implementability and community acceptance evaluation criteria.

The June 18 analysis provided additional details regarding the analysis by the LSRP and indicated that the saturated nature and "negligible shear strength" of the alum-YPS sludge in the lagoons was such that it could not be excavated and trucked out of the property. The LSRP further stated that any material from within the lagoons that could be excavated using the surrounding berms as a stable platform would need to be dewatered on the property. The LSRP stated that no such area exists that is not within the confines of the lagoons themselves or adjacent wetlands on the property.

It was further noted by the LSRP that available capacity at permitted landfills to accept 2,000,000 tons of material was limited. Further, the saturated nature of the material could pose operational issues at the landfill itself.

Thus, the LSRP concluded that Excavation of the Alum-YPS Sludge alternative was not feasible from an engineering and construction standpoint, and disposal of the 2,000,000 tons of sludge would cause engineering and operational concerns at the receiving landfill facility.

3. *In-situ Stabilization and Filling with Clean Fill*

The DLUR's previous review of this alternative noted that Rahway Arch stated that this alternative would limit the potential for future development of the site, but that the applicant did not fully substantiate this claim.

The June 18, 2013 analysis provided additional engineering information by the LSRP as to why this option was not feasible. The alternatives analysis did not discuss how and with what types of materials the alum-YPS sludge lagoons might be stabilized because there is no proven technology for stabilization of the alum-YPS sludge. Cytec had previously evaluated and rejected a concept plan to stabilize the alum-YPS sludge using Portland cement, along with other pozzlonic additives.

To evaluate this alternative, the LSRP assumed that stabilization of the alum-YPS sludge could be obtained utilizing Portland cement. The LSRP also assumed that the cement could

be mixed into the sludge in situ using a commercially available hydraulic soil mixing attachment mounted to a tracked excavator. The mixing equipment would need to start from the berms and work inward to the centers of the impoundments, once the sludge had been sufficiently stabilized to support the excavator.

The additional engineering information contained in the June 18 document further substantiated the fact this this alternative was not feasible by reviewing the properties of the fill material and underlying alum-YPS sludge. The alum-YPS sludge has lower permeability than would be obtained from the fill that would be placed on top of the stabilized sludge. The lower permeability sludge would trap water in the lagoons, continuing the existing conditions despite the addition of the fill. As discussed in the June 18 document, one of the primary rules in designing a cap system is that the permeability of the cap material must be less than the permeability of the underlying materials.

The alternatives analysis focused on the fact that this alternative would not achieve the remediation requirements for the site. The sludge itself would still be of lower permeability and the impoundments would still retain water. The LSRP used the term "bathtub effect" to explain that the retained water would still leach through the sludge to the underlying groundwater and then to surface waters. Since the clean fill has a higher permeability than the alum-YPS sludge, water that percolates through the clean fill will be trapped by the sludge. This water will continue to accumulate until the clean fill is saturated. As was described in the June 18 letter, allowing the fill material above the sludge to become saturated will increase the volume of water that percolates through the sludge because it will increase the hydrostatic head that pushes the water through the sludge.

Further, the placement of clean fill of higher permeability over the sludge material would over time get saturated itself by the water retained in the impoundments and would not be able to serve as an acceptable cap for the sludge lagoons themselves. Saturating the fill will lower its shear strength and maintaining the alum-YPS sludge in its current saturated state will ensure that its shear strength will remain negligible. In addition, the impoundments would still not be stable enough to allow for further development on the property and the lagoons themselves would continue to be a site hazard.

Cytec had previously evaluated the permeability of the alum-YPS sludge in the lagoons. The average permeability was $3x10^{-5}$ cm/s with the lowest permeability at $8x10^{-6}$ cm/s. Permeability of the sludge was lowest in the centers of the impoundments and increased near the berms. Any cap system used on the site must have a lower permeability than the sludge to prevent water from continuing to pond inside the impoundments.

The clean fill considered by this alternative was common borrow. Common borrow is clean fill soil imported from off-site sources that does not meet any specific engineering requirements, has a gradation range from gravel through silts and clays and is commonly used for embankments, rough site grading and most of the fill on road construction projects. Its gradation will vary significantly based upon the source of the borrow material. Depending upon the gradation, permeability will range from $1x10^{-2}$ to $1x10^{-4}$ cm/s. In any case, the

permeability of this fill will be higher than the alum-YPS sludge, causing water to be trapped within the impoundments.

By means of contrast, the engineered fill from the Class B recycling facility that will be used to cap this site under Alternative 7 (Preferred Alternative), has a permeability of $2x10^{-6}$ cm/s or less. Therefore, the engineered fill will create an effective cap because it has a lower permeability than the underlying material. Water will run off the surface of the cap and not accumulate in the impoundments. As part of Alternative 7, this water runoff will be collected and managed in a stormwater management system and will be discharged in a controlled manner to prevent erosion and flooding.

The LSRP determined that this In Situ Stabilization alternative would not meet the remediation requirements of 1) eliminating the infiltration of runoff into the underlying groundwater, 2) addressing the site hazards associated with the unstable lagoons, and 3) allowing for future development. Since this approach does not meet the identified remediation requirements, as established by the LSRP, it would also not comply with the Tech Rule and ARRCS as required for the site to be remediated to allow for an RAO to be submitted for the site.

4. *Fill the Alum-YPS Sludge Ponds with Unprocessed Alternative Fill from Outside Sources*

The January 2013 and June 18, 2013 analysis provided by the LSRP stated that this alternative would essentially be no different than Alternative #3 in that the alternative fill from outside sources, which would be unprocessed and unscreened, would be of higher permeability that would over time become saturated by the water retained in the impoundment areas. This would result in the impoundments continuing to be unstable and would not address the unsafe conditions at the site.

The June 18, 2013 analysis further expanded on the issues surrounding the alternative fill by explaining that the geotechnical properties of material from outside sources would be variable as it would not be processed to provide consistent gradation and uniform geotechnical properties. The fill sources would also likely contain large volumes of oversize material (construction and demolition debris) since it would not be screened prior to its placement within the impoundments.

Similar to Alternative #3, the Fill the Alum-YPS Sludge Ponds with Unprocessed Alternative Fill alternative would not meet the remediation requirements of 1) eliminating the infiltration of runoff into the underlying groundwater, 2) eliminating the site hazards associated with the unstable lagoons, and 3) allowing for future development.

Since this alternative does not meet the remediation requirements, as established by the LSRP, it would also not comply with the Tech Rule and ARRCS as required for the site to be remediated to allow for an RAO to be submitted for the site by the LSRP.

5. *Fill the Alum-YPS Sludge Ponds with Alternative Fill and Cover with a Geomembrane Cap.*

The June 18 letter discussed why this alternative is not a prudent alternative for remediation of this site. The geotechnical and remedial investigations have shown that extensive settlement will occur as the alum-YPS sludge and the underlying peat layer are consolidated by the load from the fill. This settlement will occur over time and will be monitored during the remediation using the groundwater and geotechnical monitoring systems described in the RAWP and the RAWP Addendum.

A geomembrane over this fill will experience tensile stress caused by the settlement of the underlying materials. The elasticity of a geomembrane is relatively low. Since the material will not stretch in response to these tensile stresses, it will fail. These failures may occur in both the fabric and at the welded seams. Failure of the geomembrane will create holes through which water can infiltrate into the underlying material.

The geomembrane cannot be left exposed at the surface. It must be covered with a soil layer to provide UV protection and to grow grasses over the site. Since the geomembrane would be buried beneath soil and grass and cannot be observed from the surface, it cannot be determined whether any failure has occurred. A failure of the geomembrane could therefore go undetected for long periods of time, reducing the effectiveness of the remediation without any visual indication at the surface. As a result, the long term effectiveness and performance of this alternative would be reduced.

The long term effectiveness and performance of this alternative is further compromised because it does nothing to stabilize the existing berms. The geotechnical analysis of the remedial action demonstrated that to achieve the necessary factors of safety to ensure the long term stability of the berms, strict geotechnical specifications for the fill material must be met. The unprocessed alternative fill considered by this alternative, as well as the fill considered for Alternatives 3 and 4, will not possess the geotechnical characteristics necessary to meet these specifications. Only by processing the fill through the Class B recycling facility, (Alternative 7 – the preferred alternative) can those specifications be achieved.

The geomembrane may also limit future development of the site by impacting a developer's ability to construct footings and a foundation over the geomembrane liner.

Since this Alternative Fill and Geomembrane alternative does not have long term effectiveness it would be less effective than the preferred alternative. In addition, it would cost approximately twice as much as the preferred alternative. Therefore, the LSRP determined that the preferred alternative is the better option for remediation of this site.

6. *Use of Processed Dredged Material (PDM) as Alternative Fill*

As noted in the DLUR engineer's review of the January 2013 alternative analysis, Rahway Arch did not consider this alternative as a viable approach because PDM material (which is sediment processed with Portland cement) that could be used on the site would not be fresh material. PDM is processed by mixing 7-8% portland cement into the dredge materials. The cement starts to hydrate immediately after mixing. If the PDM is not placed quickly, the cement will harden and the resulting PDM fill will be fairly granular and have higher permeability than would be acceptable for the cap. The shear strength would also be lower than the engineered fill. As a result the PDM would be a more granular material than the engineered fill and would not have the reduced permeability necessary to cap the site and would have a lower shear strength. The unreliability of the supply of PDM material, the need for additional permitting, and the longer project schedule due to possible lack of availability of PDM further reduce the viability of this alternative. The analysis also determined that it would be only marginally effective as a remediation alternative for both short term effectiveness and implementability.

In the June 18, 2013 letter, the LSRP expanded on the previous statement that "a lack of homogeneity among various PDM sources" was one reason why this alternative was not feasible. Specifically, as is the case with outside sources of alterative fill (soil), PDM is available from various dredging contracts for the NY/NJ Harbor Complex, but the homogeneity of the material varies depending on the location in the harbor where the sediments were removed. Thus, the material once processed can vary in its composition and in its geotechnical properties. In addition, PDM has a higher moisture content than most soils which presents additional engineering concerns with its use as fill material in the remediation of the alum-YPS sludge lagoons. Use of PDM has the additional potential to introduce more water into the lagoons that could leach contaminants into the underlying groundwater and adjacent surface waters.

Similar to Alternatives 3, 4 and 5, due to the higher permeability and higher moisture content of the PDM versus the alum-YPS sludge material, the PDM would not serve as an effective fill or cap material in the remediation of the site and thus would not meet the LSRP's remediation requirements of 1) eliminating the infiltration of runoff into the underlying groundwater, 2) addressing the site hazards associated with the unstable lagoons, and 3) allowing for future development.

Since this Processed Dredge Material alternative does not meet the identified remediation requirements as established by the LSRP, it would also not comply with the Tech Rule and ARRCS as required for the site to be remediated to allow for an RAO to be submitted for the site.

It should also be noted that, over the years, several concept plans to cap the site using processed dredge material were abandoned prior to final design and implementation. Technical issues with the site and market supply of acceptable materials were the primary reasons cited.

7. *Cap Site with Processed Class B Recyclable Soil – PREFERRED ALTERNATIVE*

As identified in the January 17, 2013 Detailed Alternatives Analysis, this approach calls for the capping of the site with alternative fill that has been blended, screened and processed into an engineered fill that will have consistent geotechnical properties due to the material being processed in a single Class B recycling facility to produce a structural fill. As is described in detail in the Fill Use Plan contained in Section 7 of the RAWP, processing in the Class B recycling center begins with the soil being blended to achieve consistent geotechnical properties. The blended soil is then screened to remove oversize, typically rocks and incidental amounts of asphalt, concrete, brick and block. The screened soil is processed in a pugmill where it is blended with pozzlonic additives. Oversized material removed in the screening process is crushed and either returned to the raw material stockpile for re-processing or used on site as crushed aggregate. The process results in an engineered fill material that has consistent geotechnical properties.

Experience with this engineered fill product on other capping sites in New Jersey has shown that the Soil Safe product achieves the consistent geotechnical properties necessary for this project. The product has consistently met an AASHTO A-2-4 soil classification, can be readily compacted to 92-95% of modified Proctor and when properly placed and compacted achieves permeability in the order of $1x10^{-6}$ cm/s.

Consistent properties are achieved because the soil is processed through the Class B recycling facility. Processing provides consistent classification and moisture content, resulting in a consistent grain size distribution and elimination of deleterious and oversized materials. This then allows proper spreading and compaction. The pozzlonic additives increase the strength and result in lower permeability in the compacted engineered fill.

The engineered fill material is placed in 8-12 inch loose lifts by a bulldozer and compacted with a vibratory roller. The material is placed at a moisture content 0-2% above optimum to further aid in compaction and permeability reduction.

The engineered fill material is handled and placed as a granular material, and it exhibits the geotechnical properties of the blended soil. However, after the material has been placed and compacted, the additives hydrate and form a solid soil-cement matrix.

The engineered fill will be processed to meet the engineering specifications of a lower permeability than the underlying alum-YPS sludge, and a high shear strength to serve as cap material over the entire site that will also address the site hazards associated with the unstable lagoons and berms.

Chemical composition of the alternative fill is described in the RAWP and RAWP Addendum approved by the LSRP and reviewed by SRP, and meets the requirements of the Fill Guidance document. The alternative fill complies with the alternative fill requirements of the Tech Rule (NJAC 7:26E-5.2(b) and Chapter 4 of the Fill Guidance document. The concentrations in the alternative fill will be below Residential Standards for all parameters

except the six individual PAH compounds that presently exist on the site at concentrations above the Residential Standards. The concentrations of these six PAH compounds will be less than half of the existing concentrations of these compounds on the site. Use of Alternative Fill on this site is supported by the Fill Guidance. This approach as proposed meets all of the remediation requirements as detailed by the LSRP in the RAWP, RAWP Addendum and the Clarification Letter.

Stabilization of the unsafe conditions in the existing lagoons is fully addressed by this Cap with Processed Class B Recycled Soil alternative because of the consistent geotechnical properties that will be achieved by manufacturing the engineered fill at the on-site Class B recycling facility. The increased shear strength and reduced permeability that will be achieved by the solidification /stabilization process used in the Class B recycling facility and the proper placement of the engineered fill product using the strict placement specifications will remediate these conditions. The structural stability of the capping system, the capped site and the containment berms using the engineered fill product and the placement specifications was verified by the geotechnical consultant based upon the existing site conditions and the minimum acceptable properties of the engineered fill. The stability of the site, including the berms, will be monitored during construction of the cap system by the geotechnical consultant who will report the results to the LSRP. The geotechnical monitoring program is described in the RAWP.

As a result of all of the detailed engineering analyses, the Cap with Processed Class B Recycled Soil was selected by the LSRP as the preferred alternative.

2. *The Department determines that the cost of compliance with the requirements of this chapter is unreasonably high in relation to the environmental benefits that would be achieved by compliance; and*

N.J.A.C 7:13-11.17 prohibits the placement of hazardous substances, in this case recycled petroleum-contaminated soils, in the flood hazard area. Although containing a hazardous substance under the Spill Act, the engineered fill product from the Class B facility will meet the N.J.A.C. 7:26E-1.8 definition of Clean Fill and the SRP definition of Alternative Fill.

One alternative for the remediation of this site that clearly meets the requirements of N.J.A.C. 7:13-11:17 is Alternative #2. Alternative #2 involved excavating the 2,000,000 tons of contaminated fill (sludge lagoons and surrounding berms) from the site, and importing the same volume of clean fill to raise the site above the ABFE to allow for development of the site. The cost to implement this remedial approach for the site is $265,000,000, compared to the preferred alternative cost of $15,000,000. It should also be noted that this alternative was deemed not feasible from engineering and construction standpoint based on the existing unstable site conditions and the fact that disposal of the sludge lagoon material at a permitted landfill, if capacity could be found, could create a new set of environmental impacts at the landfill itself.

Alternative #3 may also meet the requirements of N.J.A.C. 7:13-11.17 in that the alum-YPS sludge lagoons would be stabilized and "clean fill" would be used as the cap material for the remediation of the site. While this alternative does address the regulation because hazardous

substances would not be placed in the flood hazard area, as discussed in the alternative analysis, this approach does not resolve the underlying issues with the sludge lagoons and impacts to the underlying groundwater and adjacent surface waters of the Rahway River from water continuing to be retained in the lagoons and the inability of the clean fill to serve as cap material given its geotechnical properties. The cost to implement this remedial approach was determined to be $304,000,000, compared to the preferred alternative cost of $15,000,000.

Thus, the cost to comply with *N.J.A.C.* 7:13-11.17 through the implementation of alternatives 2 and 3 would be significantly higher than the preferred alternative, and the two identified alternatives that would meet the regulation requirements have been determined not feasible from an engineering and construction standpoint to meet the remedial objectives for the site as approved by the LSRP in the RAWP to meet the Tech Rule and ARRCS.

3. *The Department and applicant agree to one or more alternative requirements that, in the judgment of the Department, provide equal or better protection to public health, safety and welfare and the environment.*

The LSRP has determined that the preferred alternative meets all of the remedial objectives that have been deemed necessary to properly remediate the site as set forth in the RAWP approved by the LSRP.

Remediation of the site will be implemented in accordance with the RAWP, which has been prepared in accordance with the Tech Rule and ARRCS. The Department finds that the alternative contained in the RAWP will provide better protection to public health, safety and the environment than the current site conditions.

This preferred alternative consists of importing soil to a temporary Class B recycling facility located on the site. The Class B recycling facility will process the imported soil to manufacture engineered fill that will meet the environmental and geotechnical specifications needed to properly remediate this site. The temporary Class B recycling facility will be dismantled and removed from the site near the end of the remediation project.

The cap system for the site has been designed to meet the remediation requirements established by the LSRP to remediate the site in accordance with the Tech Rule and ARRCS and to allow issuance of a final remediation document. The grading shown on the remediation plans is the minimum volume of engineered fill necessary to construct a capping system that meets the remediation requirements and to provide short term and long term protection of human health and the environment.

The use of an on-site Class B recycling facility provides the highest level of quality control on the engineered fill. Soil Safe, the reclamation contractor, will both manufacture and place the engineered fill and construct the capping system. This ensures both the availability and quality of the engineered fill product to meet the cap system requirements within the regulatory timeframe available for site remediation.

Importing engineered fill from an off-site facility to remediate the Rahway Arch property is not economically viable because it would require double handling of the soil and a haul, by truck, from the off-site facility to Rahway Arch. Soil Safe operates a Class B recycling facility in Logan Township, Gloucester County, New Jersey, for the purposes of remediating several sites in the Logan Township area. Ignoring the facts that the environmental and geotechnical criteria for the engineered fill at the southern New Jersey sites are different from the requirements at the Rahway Arch property and that the Rahway Arch property is not an approved end market for the Logan facility; importing engineered fill from Logan would create a significant negative environmental impact.

To evaluate the environmental impact of importing engineered fill from Logan into Rahway Arch, Soil Safe provided source location data for the recyclable delivered to Logan for the five year period from 2008 through 2012. This data was analyzed to identify the sources that were closer to Rahway and the sources that were closer to Logan. Sources closer to Rahway were New York, Connecticut and the New Jersey counties north of Trenton (Bergen, Essex, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Passaic, Somerset, Sussex, Union and Warren Counties). All other sources were considered to be closer to Logan.

Over the past 5 years, Soil Safe has recycled 2,640,000 tons of soil at Logan. Of that total, 2,060,000 tons (78% of the total) came from locations that are closer to Rahway Arch than to Logan. Assuming that this trend continues, placing the Metro12 Class B recycling facility at the Rahway Arch Site and recycling this soil there rather than at Logan will reduce the haul distance of all of the raw material necessary to remediate the Rahway Arch property.

The Logan property is approximately 100 miles south of the Rahway Arch property. For sources north of the Rahway Arch property, construction of the Metro12 site will reduce the haul distance by 100 miles. For sources between Trenton and Rahway Arch, construction of the Metro12 site will reduce the haul distance by up to 60 miles.

In addition, if the engineered fill product is manufactured at Logan, it must be then loaded onto trucks and hauled north to the Rahway Arch site, an additional 100 mile haul distance. Therefore, construction of the Metro12 facility will eliminate between 160 and 200 miles of haul distance for all of the soil that is needed to remediate the site.

Looking at this from an environmental standpoint, the impact to the environment is a direct function of vehicle miles traveled (VMT). These impacts will include diesel fuel, exhaust emissions and road wear and tear. Secondary impacts also include safety concerns about additional trucks on crowded highways, vehicle wear and tear and potential damage to other vehicles from tires and other debris.

A truck hauling soil will carry a payload between 20 and 25 tons. Hauling 2,000,000 tons of soil will require 80,000 truckloads at 25 tons per load. These trucks will average between 5 and 6 miles per gallon of diesel fuel. At 5 mpg, the additional 60 mile haul distance to Logan will expend 960,000 gallons of diesel fuel. The haul of the engineered fill product from Logan to Rahway Arch will expend 1,600,000 gallons of diesel fuel. Therefore, the impact of not constructing the Class B at the Rahway Arch site will be wasting 2,560,000 gallons of diesel

fuel. Burning 2,560,000 gallons of fuel will result in corresponding emissions of particulates, CO, $CO_2$ and $NO_x$ furthering the negative environmental impact of not constructing the Class B recycling facility on the Rahway Arch site.

2nd Tier

Under N.J.A.C. 7:13-9.8(b), the Department must make a positive finding that **all** of the requirements below have been met in order to entertain a hardship exception:

1. *Due to an extraordinary situation of the applicant or site condition, compliance with this chapter would result in an exceptional and/or undue hardship for the applicant;*

   To comply with the requirements of N.J.A.C. 7:13-11.17, by not placing the engineered fill in the flood hazard area, would in essence mean that the LSRP approved RAWP could not be implemented for this site. As noted previously in the discussion regarding the "No Action Alternative," the site is currently a hazard to the public due to the contamination and the unstable conditions of the alum-YPS sludge lagoons and berms. The contamination present in the sludge lagoons and surrounding berms is in need of remediation to address ongoing discharges to groundwater and surface waters of the adjacent Rahway River.

   In addition, the No Action Alternative would place an exceptional or undue hardship on the applicant because it would leave the site in an unusable condition. Section 47g (1) of SRRA states that the Department may disapprove the selection of a remedial action for a site on which the proposed remedial action will render the property unusable for future development or recreational use. A further exceptional or undue hardship will be placed on the applicant if the No Action Alternative is implemented because left un-remediated, the existing berms will fail at some point it time, releasing cyanide sludge into the Rahway River. As property owner, the applicant will likely be considered a responsible party and be liable for remediation costs associated with this release, a cost that will be much higher than the cost to properly remediate the site by constructing the engineered fill capping system (Alternative 7).

   All of the other alternatives for site remediation were determined to be ineffective in remediating the site and/or were not feasible. Similar to the No Action Alternative, attempting to remediate this site using one of those alternatives will place an exceptional or undue hardship on the applicant because they will eventually fail, requiring additional remediation efforts, potentially causing a large scale release and cleanup liability. Most of the other alternatives will also not permit future site use.

2. *The proposed activities will not adversely affect the use of contiguous or nearby property;*

   Approval of the hardship exception would not adversely affect the use of contiguous or nearby properties in terms of impacting the ability of those properties to be developed from a land use perspective. Therefore, this requirement has been met.

3. *The proposed activities will not pose a threat to the environment, or to public health, safety and welfare; and*

The proposed remediation of the site, as approved in the RAWP by the LSRP, is being implemented by Rahway Arch to address the current threat the site itself currently poses to the environment, public health and safety based on the unstable conditions within the alum-YPS sludge lagoons and the ongoing discharge of contaminants from the site to the underlying groundwater and surface waters of the Rahway River. The threat to the environment and public health and safety would be to **not** perform the site remediation.

As is described in detail in the RAWP and summarized in this document, the engineered fill used for the cap will not pose a hazard to human health or the environment. The engineered fill will meet Residential Standards for all parameters except for the six PAH compounds that presently exist on the site above Residential Standards. The PAH concentrations in the engineered fill will be less than half of the existing concentrations, before even taking into account the treatment of the engineered fill product through the solidification/stabilization process. Solidification/stabilization is considered by U.S. EPA a Best Demonstrated Available Technology (BDAT) for treatment of soils. Additional justification regarding the PAH concentrations, including the protectiveness of the plan, is documented in the August 16, 2013 RAW Addendum. The LSRP has determined that this engineered fill capping system is fully protective and is the only viable option to protect human health and the environment at this site.

In addition to the quality of the engineered fill, the capping system has been designed to meet all of the remediation requirements for this site. Stormwater will be collected and managed in a stormwater management system and discharged to control erosion and prevent flooding. Stormwater will not be allowed to percolate into the existing contaminated alum-YPS sludge and undocumented fill soils on the site where it would negatively impact both groundwater and the Rahway River. The berms will be stabilized to prevent failure and release of the alum-YPS sludge. The site will be stabilized, eliminating safety concerns.

Remediation of this site will have no impact on flooding in the area. It is important to note that the site has already been filled with 2 million tons of contaminated alum-YPS sludge and undocumented fill. Any flooding on the site has the potential to release this contamination. The site is located in a tidal flood zone of the Rahway River. Any flooding that occurs in the area surrounding this site is tidal flooding caused by the Atlantic Ocean, and is not fluvial flooding caused by upstream runoff. Fill placed in the tidal flood fringes does not impact flood storage or displacement because the Atlantic Ocean, not rainfall or stormwater, impacts flood levels.

The resulting remediated site will consist of 55 to 65 acres of remediated habitat, 20 to 30 acres of developable property and 40 acres of undisturbed wetlands.

4. *The hardship was not created by any action or inaction of the applicant or its agents.*

The current site conditions were not created by Rahway Arch, the third party developer, but were caused by the responsible party, Cytec and its predecessors (American Cyanamid), by creating the

YPS-sludge lagoons in the first place, and by not maintaining the proper institutional and engineering controls on the site as required by the Site Remediation Program and the No Further Action issued for the site. The NFA for the site required the responsible party to maintain the required engineering controls on the site and certify that the controls were functioning properly. Rahway Arch's purchase of the property for intended remediation is neither "action" nor "inaction" by the applicant that resulted in the current contaminants of the property.

Conclusion

Based on further evaluation of the hardship exception requests and all additional supporting documentation and information, the Department has determined the following:

(1) No hardship exception from *N.J.A.C.* 7:13-11.16 is required because unsecured material will not be stored in a regulated area,

(2) No hardship exception from *N.J.A.C.* 7:13-11.18 is required because the material to be processed and placed is categorically approved for beneficial use pursuant to *N.J.A.C.* 7:26-1.7(g), and so is not considered solid waste,

(3) No hardship exception from *N.J.A.C.* 7:13-11.17 is required for the processing and storage of material at the proposed temporary Class B recycling facility as that facility will be located at an elevation above the ABFE, and

(4) A hardship exception from the requirements of *N.J.A.C.* 7:13-11.17 is granted for placement of material to create the proposed temporary Class B recycling facility and for the implementation of the LSRP-approved RAWP dated July 16, 2013, as amended on August 15, 2013, and as clarified in the applicant's August 23, 2013 letter.